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PLANT PROTECTION BULLETIN

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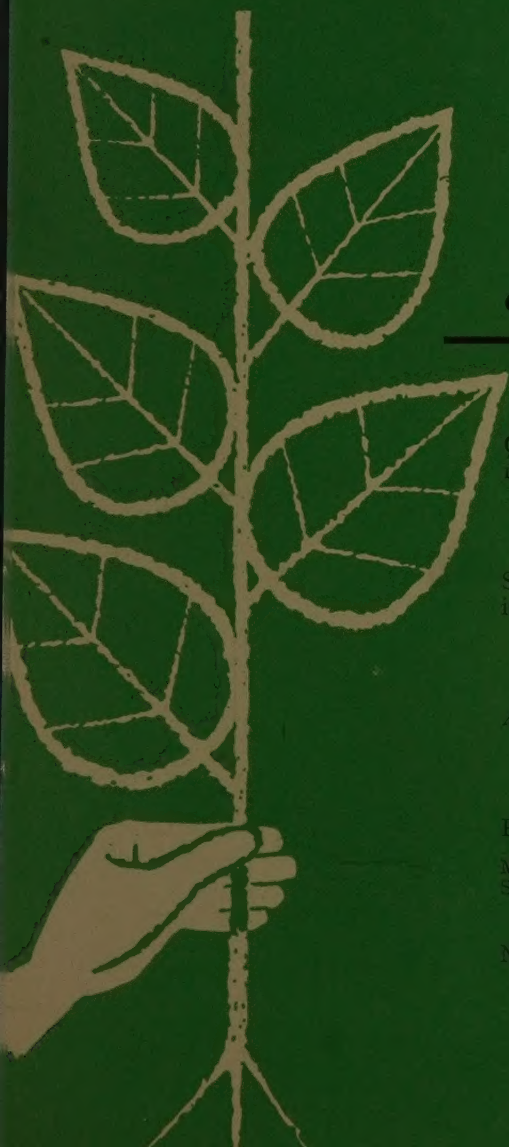
A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS



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FAO PLANT PROTECTION BULLETIN

is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

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FAO PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

Quarantine Arrangements for Intercepting Cocoa Material Infected with West African Viruses

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At the first FAO Technical Cocoa Meeting held in Accra in February 1959, many delegates stressed the importance of distributing improved planting material and disease-resistant clones throughout the major cocoa-growing areas of the world. It was also emphasized that every precaution should be taken to ensure that pests and diseases are not spread in this way. Indeed, a special session was held to discuss quarantine arrangements, particularly those designed to reduce the risks of spreading viruses. These are widespread and important in West Africa, where they have been found in Sierra Leone, the Ivory Coast, Ghana and Nigeria. Viruses also occur in Trinidad and Ceylon and suspicious symptoms have been reported from Java, Sumatra and certain South American countries (4). The apparent absence of virus from some of the most important cocoa areas and the limited distribution of the most virulent strains emphasize the necessity for the strictest possible quarantine control.

It was suggested in Accra that quarantine stations should be established at main centers of communication in the Americas, Africa and the Pacific, to handle the exchange of material within and between continents. Puerto Rico, Kano in Northern Nigeria and an accessible island in the Pacific or Indian Oceans were suggested as possible sites in tropical areas where cocoa is not already established. The methods which could be used for detecting the known cocoa viruses of West Africa and some of the problems likely to be encountered in quarantine work with cocoa are discussed in the present paper. A double grafting technique is described for testing vegetative material for virus.

Methods of detecting cocoa viruses

Various methods have been developed for detecting viruses but with cocoa the available techniques are limited. For example, the chemical tests suggested by Hancock (1) and Tinsley and Usher (6) have limited application. Furthermore, mealybug transmit only some of the known cocoa viruses and are not always readily available or easy to handle (3). Thus, grafting is the only reliable method and the presence of virus can be assumed if a diseased condition is transmitted by grafting infected tissues into healthy plants. At the same time, comparable uninoculated controls should remain healthy.

Symptoms are not always easy to see on infected plants and the swollen shoot and cocoa mottle leaf viruses cause a transient red banding along the veins of young leaves, which is not always followed by a permanent pattern of vein-clearing or chlorotic banding. Thus, test plants should be examined weekly to ensure that the leaves are seen before and after they mature. The plants should also be vigorous, growing in the best possible conditions and treated with foliar sprays or soil dressings of fertilizer to correct any nutrient deficiencies. Particular difficulty is encountered in Ibadan because of the alkalinity of the topsoil and the

water supply. Under these conditions, symptoms of manganese or iron deficiency frequently mask those caused by virus, unless the plants are sprayed or the soils treated with chelate compounds.

It is also essential to keep the plants in adequately screened houses and to eliminate any insects by routine sprays. These should include a systemic insecticide particularly effective against mealybugs. Additional sprays with acaricides may also be necessary, as spider mites tend to multiply and damage the leaves of potted plants kept for a long time in screened houses.

The efficiency of quarantine arrangements depends largely upon an ability to recognize the symptoms of virus infection whenever they occur on cuttings, budlings or test plants. This is easy when symptoms are obvious and can be recognized by reference to published photographs and even descriptions (4). However, viruses causing such conspicuous symptoms are likely to be detected in the country of origin and before vegetative material is dispatched. This means that quarantine officers are likely to encounter only the mildest viruses or those which occur in tolerant varieties. Under these circumstances, symptoms tend to be very inconspicuous and restricted to a few leaves, perhaps those appearing only at certain stages of development. An ability to detect such symptoms depends upon considerable experience and even then it may be necessary to carry out additional graft tests on the suspected material. For this reason it is suggested that the officers responsible for quarantine control should receive special training in symptom recognition and should also be able to consult specialists in cocoa virus research.

The movement of planting material

Seed

Despite a number of attempts, the known cocoa viruses have not been transmitted through seeds. Thus, there seems little danger in transporting them between countries, even if pods are unwittingly taken from infected trees. Nevertheless, obvious precautions are to collect seed only in disease-free areas and from trees which are inspected for virus symptoms at regular and frequent intervals.

Fermentation and breakdown of the pulp start immediately after the pods are broken. The discussions in Accra showed that there is no agreement on the best methods of preparing, cleaning and packing seed. Consequently, seeds are most conveniently carried in intact pods but this is dangerous because the husks of pods from infected trees contain virus which is readily available to the mealybug vectors. These and other insects together with fungi are commonly present on the surface of pods and are difficult to eradicate from the crevices and insect galleries. Thus, intact pods should be transported only when absolutely necessary. They should then be carefully selected and sterilized before and after transit and the husks destroyed as the beans are removed.

Rooted cuttings

Vegetative material of particularly valuable clones has been in demand for many years and shipments are likely to increase as vigorous hybrid or resistant selections become available. The usual practice has been to transport rooted cuttings from which the soil has been removed. This is sometimes successful but heavy losses have been experienced within West Africa through delays in transit and difficulty in re-establishing the sensitive material. Moreover, the practice of maintaining cuttings under quarantine conditions and releasing them after inspecting for symptoms over an arbitrary period is an inefficient method of detecting virus. Some material, particularly of fan cuttings, makes limited growth in quarantine and deficiency symptoms or growth mottles may obscure the effects of virus. These may be exceedingly mild with certain combinations of virus and host, and some material tolerates infection with even the most virulent strains. Symptoms are then difficult to detect by even the most skilled and experienced observers. For these reasons it is suggested that the movement of rooted cuttings should be restricted, unless supplementary graft tests are carried out. The movement of clones in the much

more convenient form of budwood provides a satisfactory alternative.

Budwood

Budwood of many different crop plants is frequently exchanged between countries and it can be sealed in polythene bags and transported much more readily than rooted cuttings or even seeds. The procedure has other advantages, as budwood can be taken from vigorous seedlings or rooted cuttings which have been grown and inspected under screened conditions in the exporting country for a sufficiently long period to indicate that they are free from virus. Furthermore, top-working the source with susceptible buds can be used as an additional check on the presence of virus and is recommended for clones which tolerate infection.

The bud sticks for transit should be cut from vigorous hardened shoots tapering from a diameter of $^3/_4$ inch. The leaves should be removed to leave the basal pulvinus of the petiole, and the bud sticks should be surface-sterilized and packed in moist filter papers inside polythene. Care should be taken to ensure that the package is not delayed in transit or exposed to extremes of heat or cold. On arrival, buds should be removed and grafted to vigorous healthy stocks at the earliest opportunity. The most satisfactory buds are those on portions of the mature stem from which the leaves have fallen naturally. However, buds in the axils of mature leaves can be used also and little difficulty should be experienced in getting a percentage of the buds to develop. The successful budlings should grow rapidly under good conditions and any infection is likely to be diagnosed by thorough and frequent inspections over a period of several months.

Some infection, particularly in tolerant material, is unlikely to be recognized in this way and top-working with a susceptible bud should be used as a final check on the presence of virus. Thus, it is suggested that all symptomless budlings which have grown to graftable size should be cut back and budded with a healthy Amelonado clone, such as West African Cocoa Research Institute selection C14. The

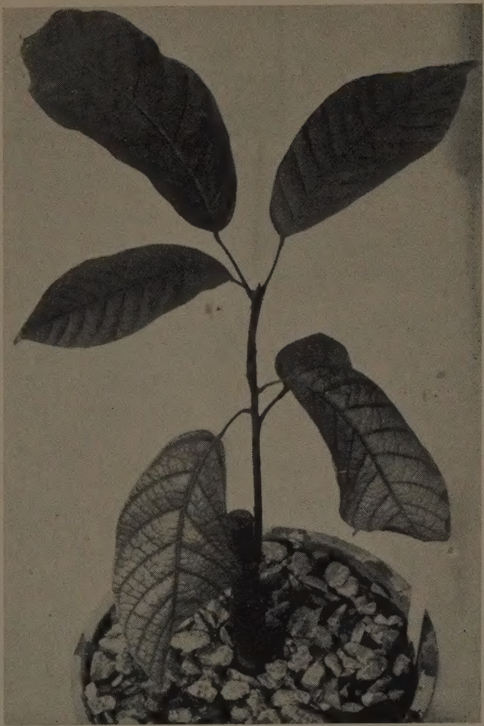

Figure 1. Conspicuous leaf symptoms and a stem swelling produced after grafting a healthy Amelonado cocoa bud onto a stock which was infected with cocoa swollen shoot virus.

detached shoots can be used to maintain the introduced clone by rooting hardwood cuttings or grafting buds onto healthy stocks. This material can then be released as healthy and suitable for general distribution, once the indicator shoot on the original top-worked plant has produced three or four symptomless flushes. Double working techniques of this type have already been used extensively for testing tolerant varieties of certain tree crops and they have given satisfactory results with cocoa in Ibadan (Figure 1).

Future developments

These observations are based on experience in West Africa with the three viruses occurring there. Further work may reveal additional

tests which would simplify the present arrangements and facilitate diagnosis. For example, the application of chemical or serological methods as used in potato inspection would be a considerable advance. An additional possibility is that particularly sensitive indicator clones may be selected and used as stocks or for top-working suspected material. Existing techniques may also have to be modified if new viruses are discovered.

Summary

There is an increasing demand for the exchange of cacao material between the major producing countries but viruses may be spread in this way and rigid quarantine control measures are essential. The movement of beans is relatively safe, as the known cocoa viruses are not seed-borne, although they occur in pods taken from infected trees. By comparison, the movement of rooted cuttings is dangerous and vegetative material is best handled as budwood. This can be collected from plants already growing in isolation and, after transit, should be multiplied on susceptible stocks. As a final test for the presence of virus, the budlings should be top-worked with susceptible material.

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Some Important Developments in Plant Diseases in the United States in 1959[1]

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Southwestern cotton rust

Southwestern cotton rust, caused by *Puccinia cacabata* Arth. & Holw. (= *P. stakmanii* Presley & King), has occurred more or less regularly for many years in southern Arizona and southwestern New Mexico but is seldom of economic importance (8).

In 1959 the disease was epidemic in southwestern New Mexico. In Dona Ana County the infection was localized; in Luna County it was light to moderate; and in Hidalgo County it was severe, causing 50 to 75 percent loss in the vicinity of Rodeo.

The pycnial and aecial stages of the rust fungus occur on cotton (*Gossypium* spp.) and the uredinial and telial stages on annual grama grasses (principally *Bouteloua aristidoides* and *B. barbata*).

Cotton losses result from premature defoliation, locule dwarfing due to infection on carpel walls, and peduncle infection which causes breakage and loss of mature bolls (Figure 1). The aecial stage of the rust on cotton occurred

[1]This report has been adapted primarily from recently published material.

Figure 1. Rust pustules on the peduncles, resulting in the breakage and loss of mature cotton bolls (after T.E. Smith).

in conjuction with *Alternaria* sp. Alternaria symptoms were zonate-spotting and shothole on leaves, and where both *Alternaria* and the rust fungus occurred on the same leaf defoliation was accelerated. *Tuberculina persicina* was also found parasitizing aecial pustules of the rust on the carpel walls and peduncles.

The unusual amount of cotton rust in New Mexico in 1959 may be explained by the higher than normal rainfall in July and August of 1957-59, which allowed development of grass hosts and created favorable conditions for the spread of the disease.

Control of rust by elimination of grass hosts is impractical, as heavy infection on cotton can result from inoculum from overwintered grass sites as far distant as three and a half miles. Since woody plants with little foliage suffer most, a more practical solution might be to plant cotton varieties characterized by steady vigorous growth of good color and capable of renewing foliage after an initial heavy rust attack.

Barley yellow dwarf on oats

Barley yellow dwarf, an aphid-transmitted virus disease of oats, barley and wheat, caused widespread destruction of the 1959 oat crop in the United States (6). The disease was present in 22 states and eastern Ontario, Canada, and, in terms of total loss, it was estimated to be one of the worst epidemics on oats in the country.

The disease was most severe in eleven states of the north-central region (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota and Wisconsin) but caused heavy localized infection in parts of five southern states (Florida, Georgia, Mississippi, North Carolina and Texas), four western states (Idaho, Montana, Oregon and Washington) and two states in the northeast (Maine and New York).

Barley yellow dwarf virus is known to be transmitted by several aphid vectors. According to investigations on host-vector relationships, strains of this virus are vector-specific and the virus is persistent in the vector (9). During the 1959 epidemic, the greenbug, *Toxoptera graminum* (Rond.), was mainly responsible for the transmission of the virus in the north-central region. In most of the other states either the greenbug, the apple grain aphid, *Rhopalosiphum fitchii* (Sand.), or the English grain aphid, *Macrosiphum granarium* (Kirby), were the principal vectors. Other aphid vectors reported capable of transmitting the virus were the corn leaf aphid, *R. maidis* (Fitch), the bird cherry oat aphid, *R. padi* (L.), the rose grass aphid, *M. dirhodum* (Walker) and *R. poae* Gill. Although the last two were vectors in 1959 in Wisconsin, they were not important in the epidemiology of the disease.

North-central region

Illinois

Barley yellow dwarf achieved epidemic proportions in the west-central and central parts of the state, as well as in localized areas in the east-central part. In the northernmost and southernmost regions damage was local and less severe. Intensity of damage depended upon preferential colonization and feeding by the vector, time of infection, secondary infection by soil pathogens and variety of oats. Putnam, Newton, and Tonka (Early Clinton) oats sustained less loss than the more susceptible varieties Clintland 60, Clinton, Clintland, and Minton.

Indiana

Excessively heavy populations of greenbugs, as well as of English and apple grain aphids, in May, led to an early prediction of prevalent infection of oats, a prediction amply borne out by the occurrence of the worst yellow dwarf attack on record. Early plantings were not so severely damaged as later plantings, but symptoms in both cases were typical of the disease : severe stunting, intergrading red to yellow foliage and failure of most tillers to produce fruiting panicles. Back-cross derivatives of the susceptible variety Clintland suffered heavy damage, while derivatives of the Putnam variety showed much milder symptoms and had little impairment of yield. The systemic insecticide Dimethoate was used to ad-

vantage against the vectors and served to control virus spread. However, despite such sprays, oat loss for the state was 27.5 percent of the total yield, a loss ascribed directly to yellow dwarf.

Iowa

The year 1959 was the second epidemic year for yellow dwarf on oats in Iowa, loss being estimated at 12 percent. The first epidemic year was 1949, when yield was reduced by 15 percent. In 1959, however, the disease was more devastating in individual fields than it had been ten years previously, when it was more or less evenly distributed over the state.

In 1959 only the extreme northwestern and southeastern regions were severely affected; in the remainder of the state infection was spotted and contributed little to over-all loss. Attack was heavier in fields with sparse stands and of low soil fertility but, contrary to the usual epidemiological pattern of spread in Iowa, barley which ordinarily is the first cereal to show yellow dwarf symptoms, was scarcely affected by the disease in 1959.

Kansas

The outbreak in 1959 was the worst ever recorded on both spring oats and spring barley in Kansas. Winter barley infection was much lighter. In the eastern part of the state greenbug infestation in the autumn of 1958 was high and by the beginning of May the population had increased far above normal. Feeding injury by the vector often appeared to equal the virus injury, but by the end of the growing season the total loss of the state, occurring mostly in eastern counties, was estimated at 5,923,000 bushels, or approximately 25 percent of the 1959 oat crop.

Michigan

Damage from yellow dwarf in 1959 was no worse than that in other years since 1955. Although climatic conditions favored the build-up of aphids in May, a hot spell at the end of the month checked aphid spread and limited disease infection. Severity of infection was determined largely by degree of soil fertility, variety of oats grown and date of sowing, and particularly by thickness of stand. Early Garry oats in thick stands suffered little, while Clintland and its derivatives were more heavily attacked. Losses in some fields where stands were thin and seeding was late were as high as 100 percent.

Missouri

Prior to 1959 barley yellow dwarf in Missouri had been limited to occasional, small, scattered localized areas. Except for 1949, when a moderately heavy infection occurred in an oat variety plot on the Southwest Missouri Experiment Field near Pierce City, 1959 was the first year when heavy infection made it possible to record varietal reactions. A large greenbug population built up during the spring but by early May identification of the disease was complicated by extensive aphid feeding coupled with a general bacterial infection. Later in the season typical yellow dwarf symptoms, discoloration and death of the leaves, reduced tillering, dwarfing of tillers and blasting of spikelets, could be discerned more readily. Infection was general over the state, and total loss from the disease was estimated at 37 percent.

Ohio

Barley yellow dwarf on spring oats in Ohio was more widespread in 1959 than it had been in previous years but it was spotty in occurrence. Yield reduction was indirectly related to the stage of plant development, that is, the later the planting the more severe the attack. No varieties appeared to be immune.

South Dakota

Barley yellow dwarf virus attacked oats, wheat and barley in a two-county-wide strip along the eastern end of South Dakota in 1959. In this region the disease was epidemic and infection in oat fields ranged from a trace to 90 percent. The estimated grain loss in this region was 50 percent for oats, 30 percent for wheat and 20 percent for barley. The abnormally severe loss from the disease is attributed to larger than usual populations of grain aphids in the spring.

Wisconsin

Barley yellow dwarf in 1959 was more prevalent than in any of the past 25 years, on account of the abnormally large aphid populations. Ordinarily, the greenbug is rare in Wisconsin but in May 1959 winged greenbugs were blown in from states to the south. Other vectors such as the English and apple grain aphids were also present but the greenbug was probably the chief vector involved in transmission of the virus on oats. In the southern part of the state, except in the extreme southeast, there was little damage, since the disease appeared rather late. Yellow dwarf symptoms in the northern and central regions were associated with feeding damage and drought conditions, so the closest estimate that could be made of average damage from the disease alone was about 5 percent.

NORTHEASTERN REGION

Maine

Barley yellow dwarf on oats has been widespread in Maine every year since 1955, when it was first recognized in experiment station nurseries and on farms. Oats planted early during the period from 10 to 20 May escaped serious infection, since heading occurred about 10-15 July and peak aphid infestation was not reached until late July. Severe infection of plants resulted in stunting and blasting. A survey showed that most oat fields were adjacent to, or surrounded by, forage plants such as timothy and clover, which could have been a source of early virus infection.

New York

Incidence of barley yellow dwarf on oats in 1959 was similar to that in previous years. All oat fields examined had some infection: a trace in early fields but increasing as the season progressed. This was the fourth consecutive year when infection was found in every oat field beyond the seedling stage in the Ithaca area.

The English grain aphid was the only vector collected; comparative transmission tests indicated that in New York transmission of the disease was mainly by this aphid only.

SOUTHERN REGION

Florida

Mild weather and heavy aphid infestations during the autumn and part of the winter of 1958 contributed to early yellow dwarf infection in the first week of March 1959 at Gainesville and two weeks later at Quincy. By mid-April the disease was prevalent at the North Florida Experiment Station. Later-maturing varieties such as Camellia and Red Rustproof suffered greater damage than earlier varieties; in the Quincy area yield of late varieties was reduced by 5 to 10 percent.

Georgia

Barley yellow dwarf caused much damage on oats in southern Georgia in the nursery at Tifton. Red Rustproof and Radar 2 proved very susceptible, particularly in widely spaced plants and in plants at the ends of rows. The disease apparently was transmitted only by the English grain aphid.

As an aid to evaluating possible resistance to the disease in 1960, over 3,300 entries from the world oat collection, as well as about 140 promising lines from Idaho, were planted at Tifton.

Mississippi

Barley yellow dwarf was present in all oat fields observed in Mississippi during 1959 and caused more widespread damage than ever before. Although all commercial varieties appeared susceptible, late-maturing types such as Red Rustproof suffered more than early ones. However, Delair, an early variety, was also severely infected. The disease occurred first in early March at the nursery at Stoneville. Some plants in the space-planted F_2 nursery showed bright blue to purple coloration in their leaves but most plants had brilliant red leaves. A third type of symptom also occurred in some strains in the same nursery, in which the leaves of affected plants turned straw color, much like those of a matured plant. The interaction of temperature and inherent plant characteristics might be the cause of the variation in pigmentation.

Grain losses for the state are estimated as high as 30 to 40 percent. It seems significant that a barley nursery growing contiguous to the oat nursery was not visibly infected with the virus.

North Carolina

Yellow dwarf was more prevalent in the Coastal Plains and Piedmont than in the mountainous regions of North Carolina in 1959. A rather uniform infection occurred in a planting of the Uniform Central Area Oat Nursery at Clayton, while a less uniform infection was found at Salisbury. On the basis of the amount of reddening, Appler variety appeared most susceptible, whereas Arlington and Lee varieties, as well as some experimental lines, were relatively tolerant. Although barley and wheat were also infected, the disease was much more important on oats. Virus transmission was primarily by the English grain aphid.

Texas

Yellow dwarf was responsible for stunting and discoloration of oat plants in a number of fields in 1959. Usually the disease was limited to small areas only several feet in width. Spotty occurrence and the presence of such other conditions as nutritional deficiencies made yield loss estimates from yellow dwarf impossible.

WESTERN REGION

Idaho

In the past several years barley yellow dwarf has been building up in Idaho. In 1957 it was necessary to spray late-planted experimental plots of barley and oats to control aphids. Disease incidence was worse in 1958, causing almost complete loss of some late barley fields.

In 1959 commercial fields in the southern part of the state were damaged for the first time. In other years the disease was more serious on barley, while in 1959 it was more serious on oats. Symptoms observed at Aberdeen included the appearence of water-soaked areas, followed by yellowing, blackening of leaf tips, and early death of severely infected plants. The disease was more severe where moisture was below optimum and temperatures were above normal, and it is believed that the greater amount of infection in both 1958 and 1959 was caused mainly by higher minimum and maximum mean monthly temperatures in the spring and early summer.

In experimental fields Bonneville barley and Craigs-after-lea oats, both varieties with heavy foliage, were very susceptible to yellow dwarf.

Montana

Yellow dwarf was more prevalent on barley than on oats in 1959. Oat losses were generally low in the three counties where the disease was found; however, some fields in Ravalli County had losses in yield as high as 50 percent.

Oregon

Although yellow dwarf on cereals was first found in 1954, losses did not become important until 1957. Infection in 1957 was limited to the ten counties in the Willamette Valley of western Oregon. In 1958 the disease was found in some eastern counties as well. The gradual yearly build-up of the disease is of grave concern, especially in western Oregon, where nearly 500,000 acres are devoted to the growing of grain crops. About 200,000 of these acres are planted to oats, representing about 70 percent of the total oat production of the state.

In 1959 an estimated 20 to 25 percent of the Willamette Valley cereal crop was destroyed by yellow dwarf. Several factors appear to favor the continued seriousness of the disease. First, the mild winters in the valley facilitate the aphid survival. Second, heavy rainfall in the spring, which often delays planting, gives aphids additional time to increase their populations to the peak necessary for severe infestation and subsequent yellow dwarf infection of the grain crops maturing the following summer. Third, there are extensive acreages of susceptible native and cultivated grasses which may act as reservoirs for the virus. These factors together seem to create a bleak outlook for future crops and emphasize the need for a quick solution of the problem.

Washington

Although the major grain acreages are east of the Cascade Mountains, colder winters and drier springs and summers usually do not allow build-up of large aphid populations, and consequently, except in 1958, barley yellow dwarf has not been an important disease. West of the Cascades, however, under the strong influence of the maritime Pacific air masses, the milder winters and the less dry summers are favorable to the aphid population increase. Although the western region is small as compared with the eastern region, it produces 3 to 4 million dollars' worth of grain annually, mostly oats, and yellow dwarf is severe almost every year.

Contrary to the situation in most states, in Washington in 1959 oats seeded early during 6-9 April suffered greater damage than late-planted oats. The explanation is that aphids appearing after a mild winter begin to multiply more quickly in the spring than those recovering from a cold winter. Consequently, they reach the peak earlier and can cause heavy infection in early crops. By the time late crops begin to mature, the aphid level has dropped considerably and there is less damage to crops.

Wheat streak mosaic

Wheat streak mosaic virus, transmitted by the mite vector *Aceria tulipae* (Keifer), has caused varying amounts of damage to winter wheat in the Great Plains of the United States every year since it was first isolated from diseased wheat in Kansas in 1932 (5). However, the growing season of 1958/59 marks the most severe epidemic of this disease ever recorded for Kansas (4).

A number of coincidences were responsible for the epidemic. Owing to ideal growing conditions, the 1957/58 wheat yield for the state was unusually high, in spite of wet weather and high winds, which caused a good deal of lodging. This combination resulted in much shattered seed on the ground during and after harvest. Sufficient rain during June and July caused such seed to germinate rapidly in central and western Kansas, producing volunteer wheat which persisted into early autumn and on which the mites fed and propagated during the summer. Because moisture was adequate, farmers planted earlier than normally, in late August and September, and because the autumn was unseasonably long and warm, the mites continued to increase much later in the season than usual. Tests in the autumn showed that the majority of the mites were viruliferous. By late autumn the vector populations were tremendous. Thus, the combination of an abundance of volunteer wheat, warm temperatures and large vector populations resulted in large-scale infection of the 1958/59 crop.

About 3,850,000 acres of wheat were infected with the virus, with an estimated yield loss of 46,670,000 bushels, about 20 percent of the total crop for the year in Kansas. The mosaic-tolerant varieties Kiowa, Triumph, Concho, and Bison comprise about 40 percent of the varieties grown and yield about twice as much as susceptible varieties like Ponca and Wichita, where disease infection is high.

Hoja blanca of rice

Hoja blanca (white leaf), a virus disease of rice, was found for the first time in Louisiana in 1959 (2). The disease, which is transmitted by the planthopper *Sogata orizicola* Muir, appeared for the first time in the United States at the Belle Glade Experiment Station of the United States Department of Agriculture in Florida in 1957. The next year hoja blanca was identified in Hancock County, Mississippi. In 1959 the disease was found first in Louisiana in three commercial rice fields in St. Tammany Parish ; the insect vector was also present in the infected fields. Although the disease is still confined to a single county in both Florida and Mississippi, it had been found in six more parishes in Louisiana by the middle of September 1959, in addition to St. Tammany, involving more than 1,650 acres of infected area (3).

Besides the United States, hoja blanca has been found in Cuba, Venezuela, Colombia, Surinam, Panama, Costa Rica, El Salvador, Guatemala and the Dominican Republic (1). It caused heavy losses in Cuba and Venezuela in 1956. In eastern Guatemala local varieties

and one field of Century variety rice were badly attacked in 1959 (7).

Surveys in the major rice-producing states of the United States are being continued for the purpose of locating any new outbreaks of this potentially serious disease. The Department of Agriculture is co-operating with state experiment stations in a breeding program designed to find acceptable resistant varieties. Although all the widely grown long- and short-grain U.S. varieties are susceptible, tests of several thousand rice varieties have revealed several hundred that are resistant and that may serve as the basis for future commercial varieties. The question remains whether hoja blanca will eventually spread into the three remaining large rice-producing states of Arkansas, Texas and California.

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Adoretus versutus in West Pakistan

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The medium-sized rose beetle, *Adoretus versutus* Har. (Coleoptera, Rutelinae), is very common and widely distributed in the Indo-Pakistani region. Fletcher (3) recorded this species from Bangalore, Assam and Bihar, and Arrow (1) reported it from Madras and the Central and United Provinces of Bharat. However, it was not previously recorded from the area which now constitutes West Pakistan, perhaps because of its small scattered population and slight economic importance.

During September and October 1957, the beetle for the first time appeared in very large numbers and destroyed several hundred shade and ornamental plants in nurseries at Karachi. An outbreak again occurred in 1958. Observations made on the activities of this pest are reported briefly in the present paper.

Seasonal cycle

In Karachi the beetles become active during March-April and females soon lay eggs at a depth of 3 to 4 inches in moist soil. Eggs hatch in about a week. Grubs feed on roots and take two to three months to complete their development. They seldom come out of the soil to damage the foliage. The population of adults is highest in September-October and causes serious damage to the succulent leaves. The beetles again breed heavily in autumn. Eggs hatch in about seven to ten days, grubs pupate in February-March, and adults emerge late in spring. The life cycle is thus completed in about nine to ten months.

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De Charmoy (2) observed that in Mauritius the beetle was found in great numbers all the year round except in July. Mitchell (5) reported that in Southern Rhodesia the life cycles of the beetles belonging to the genus *Adoretus* were essentially similar. Grubs pupated at the end of January and adults emerged during August and September. There was only one generation in a year. Lever (4) stated that the egg and pupal stages of the beetle in the Fiji Islands lasted for about seven and ten days respectively in February and March.

These observations show that the life cycle of the beetle varies considerably in different countries.

Habits and host plants

Adult beetles remain hidden during the day but feed voraciously on the young leaves at night. They are attracted to light, and the numbers caught in light traps represent roughly the fluctuation in their population during various months.

The weather in Karachi during September-October, particularly after rains, is very favorable to the development of the beetle. The daily records of a meteorological observatory situated very close to a heavily infested nursery showed that during these two months the average temperatures and relative humidity varied from 80.4° to 80.6° F. and 74.5 to 77.5 percent respectively.

During the outbreak period (September-October) the beetles are generally most active from 9 to 11 p.m., and after midnight, as the temperature falls, they retire to their hideouts. It is interesting to note that they are less active during moonlit nights. The beetles, in clusters of four to six individuals, feed on a leaf, con-

suming mostly the succulent tissue but leaving the midrib and other veins.

The beetle is polyphagous, although it shows preference for certain plants. In Karachi, it attacks Indian almond (*Terminalia catappa* and *T. arjuna*), rose apple (*Eugenia jambolana*), siris tree (*Albizzia lebbek*), mango (*Mangifera indica*), guava (*Psidium guajava*), mulberry (*Morus* spp.), roses (*Rosa* spp.) and several other species of ornamental plants (*Achania* and *Zinnia*). The most favored food plants are *T. catappa* and *E. jambolana*. The food preferences were determined by providing at one time the same quantity of fresh succulent leaves of three host plants to three randomized batches of ten beetles each, kept in dark at about 80° ± 1° F. and 60-70 percent relative humidity. Observations were made after 24 hours and each experiment was repeated four times. The leaf area consumed by ten beetles in 24 hours was, on the average, about 52, 6.5 and 0 percent for *T. catappa*, *E. jambolana* and *M. indica* respectively. The leaf area consumed when each host plant was separately provided was about 60, 40 and 25 percent for these three hosts respectively. *T. catappa*, with its very succulent leaves, was therefore the first choice of the beetle. Among the ornamental plants, the leaves of rose plants are the most favored food. The damage by the beetle has caused a serious setback to floriculture in Karachi.

The effect of light on feeding was also determined. It was found that the beetle did not even feed on its favored host plants directly exposed to light. The cool, shady and humid climate of plant nurseries in Karachi provides excellent conditions for the breeding and development of the beetle. However, there are fair chances of its introduction to other parts of West Pakistan, where the beetle may establish itself in the sugar cane and tobacco plantations, as reported from Fiji Islands, Southern Rhodesia and Mauritius. In 1958 the infestation had already spread to gardens and nurseries in Malir, about 12 miles east of Karachi.

Control

The beetle can be easily controlled by spraying nursery plants with DDT or BHC. A water suspension of 0.03 percent gamma BHC gives excellent kill of adults. The watering of pots and plots with 1 ounce of aldrin in 25 gallons of water once or twice during winter and spring prevents outbreaks. Treatment of soil with aldrin during summer and autumn reduces the intensity and duration of outbreaks.

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PLANT QUARANTINE ANNOUNCEMENTS

MEXICO

Executive Decree of 31 July 1959 issued by the Ministry of Agriculture and Livestock, published in the *Diario Oficial* Vol. 235, No. 34 on 8 August 1959, amends Exterior Quarantine No. 9 of 13 September 1928. By this amendment sugar cane smut (*Ustilago scitaminae*) is added to the list of sugar cane diseases, the introduction of which is to be prevented.

Exterior Quarantine No. 9 prohibits the importation of sugar cane cuttings, except for scientific purposes, under a permit from the Office of Plant Protection, on account of sereh disease, smut (*Ustilago sacchari*), downy mildew (*Sclerospora sacchari*), eye spot (*Helminthosporium sacchari*) and other dangerous diseases that are not known to occur or to be widespread in Mexico. (The name *U. sacchari* was previously wrongly applied to sugar cane smut.)

NORWAY

Royal Resolution of 12 February 1960 made under the authority of the Destructive Insects and Diseases Act of 21 July 1916, published in *Norsk lovtidend* of 5 March 1960, provides for measures against the incidence of onion-attacking races of the stem and bulb eelworm (*Ditylenchus dipsaci*) in onions intended for planting.

Importation into Norway of onion sets (*Allium cepa*), up to 25 millimeters in diameter, shallots (*Allium ascalonicum*) and other edible species of *Allium* intended for planting is permitted only if each consignment is accompanied by a phytosanitary certificate issued by the plant inspection service of the exporting country stating :

(*a*) that the onions were grown on land which was officially inspected during the growing season preceding the dispatch and found to be free from the stem and bulb eelworm ; and

(*b*) that the consignment was inspected not more than 14 days before dispatch and found to be free from the stem and bulb eelworm and other injurious pests or diseases.

In Norway the growing of onions intended for propagation is no longer permitted on land where the stem and bulb eelworm is known to occur, and the sale and alienation of onions infested by this nematode are also prohibited.

UNITED KINGDOM (England and Wales)

The Importation of Raw Vegetables Order 1960, which came into operation on 1 March 1960, modifies for specific periods of 1960 the restrictions imposed by the Importation of Plant Order 1955 (see *FAO Plant Prot. Bull.* 3 : 60-62, 1955) on the importation of certain raw vegetables, excluding potatoes, from specific districts of Belgium, France, Italy and the Netherlands.

Raw vegetables mentioned below, grown in the countries and districts specified, may be imported in 1960 during the indicated periods, provided that the consignment is accompanied by a prescribed certificate attesting that they have been examined and are believed to be free from Colorado beetle (*Leptinotarsa decemlineata*) and that they have been grown in a district where an intensive system of control of Colorado beetle is in operation.

1. Carrots with foliage not exceeding 5 inches, from Belgium, France, Italy and the Netherlands (1 April-15 October).
2. Cauliflowers, summer and winter varieties (trimmed), from Belgium (Brussels, Louvain and Malines districts only), France (Barfleur, Caen, Créances, Lannion, Nantes,

Perros-Guirec, Rennes and St. Pol de Léon districts only), and the Netherlands (1 April-15 October).

3. Globe artichokes from France (1 April-15 October).

4. Lettuce from France (in the Perpignan district, the communes of St. Laurent de la Salanque, Pia, Villelongue de la Salanque, Bompas, St. Marie la Mer, Canet, Cabestany, St. Nazaire, Saleilles, Théza, Alenya, Corneilla-del-Vercol, St. Cyprien, Latour-Bas-Elne and Elne only) (1-15 March).

5. Lettuce grown under glass, from France (in the Nantes district, the communes of Nantes, Doulon, Sainte-Luce, Thouaré and Vertou only; in the Rennes district, the communes of Rennes, Chantepie, Cesson, Sainte-Grégoire, Chartres-de-Bretagne, Châtillon-sur-Seiche and Verne-sur-Seiche only; and in the Finistère district, the communes of Plouescat, Goulven, Plouneour-Trez, Plouider, Brignognan, Kerlouan and Guisseny only) (1-30 April).

6. All other raw vegetables (including lettuce), from Belgium (Brussels, Louvain and Malines districts only) and the Netherlands (1-30 April).

The above restriction does not apply to root vegetables free from foliage, asparagus, aubergines, capsicums, cucumbers, green beans, green peas, marrows, mushrooms, onions, shallots, pimentos, pumpkins, tomatoes and witloof chicory for which no certificate is required at any time of the year.

UNITED KINGDOM (Scotland and Northern Ireland)

The Importation of Raw Vegetable Orders 1960 for Scotland and for Northern Ireland came into force on 1 March 1960. They modify for specified periods of 1960 the restrictions imposed on the importation of certain raw vegetables from specified districts of Belgium, France, Italy and the Netherlands. The provisions of the Orders are similar to those of the Importation of Raw Vegetables Order 1960 for England and Wales.

NEWS AND NOTES

PLANT PROTECTION COMMITTEE FOR THE SOUTHEAST ASIA AND PACIFIC REGION

The Plant Protection Committee for the Southeast Asia and Pacific region, which was established in 1956 by FAO in accordance with the provisions of the regional Plant Protection Agreement, held its third meeting in New Delhi, India, 9-12 December 1959. It was attended by representatives of nine governments and also by an observer from the South Pacific Commission. Dr. K.B. Lal, Plant Protection Adviser to the Government of India, was elected chairman of the Committee, to succeed Dr. T.H. Harrison, Director of Plant Quarantine of Australia, who had served as chairman of the Committee since its inception.

In addition to a review of quarantine measures needed for regulating the importation and movement of plants and plant products, the Committee discussed some plant protection problems of regional importance, including the introduction of packing materials of plant origin, methods for inspecting and treating ships and aircraft, spread of weeds, and problems involved in the movements of pests other than insects, mites and nematodes.

The Committee, through its Standing Technical Subcommittee and its technical secretary, collects information on the incidence of plant pests and diseases in and outside the region. Such information is circulated in the form of quarterly reports, information letters and technical documents.

In pursuance of the recommendation of the Committee, Mr. A. Johnston, FAO Regional Plant Protection Expert, who serves as the technical secretary of the Committee, carried out in 1959 preliminary plant disease surveys in the British Solomon Islands Protectorate, North Borneo and Sarawak, at the requests of the governments concerned. Reports on those surveys are being circulated in the Committee and may be made available at request to governmental agencies outside the region. Enquiries in this connection should be addressed to Mr. A. Johnston, FAO Regional Office for Asia and the Far East, Maliwan Mansion, Phra Atit Road, Bangkok, Thailand.

The Plant Protection Agreement for the Southeast Asia and Pacific region, which was approved by the FAO Council in November 1955, has now been signed and adhered to by 14 governments, namely Australia, Burma, Ceylon, France, India, Indonesia, Laos, Malaya, the Netherlands, Pakistan, Portugal, Thailand, United Kingdom and Viet-Nam.

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